Defining Beauty Through Computational Creativity: A Collaborative Experiment in Mathematica With GPT-4

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Beauty is an enigmatic concept that has intrigued humanity for centuries, inspiring artists, philosophers, and now, thanks to advances in technology, even computational researchers. In a collaborative journey between a human interlocutor and a machine learning model (ChatGPT), we explored the elusive notion of beauty through the mathematical framework of Julia set fractals, utilizing the Mathematica programming environment.

Note: All computer code was written by GPT-4.

The primary aim was not just to create 'beautiful' Julia fractals but to attempt a unique, computational approach to understanding what beauty could mean in the realm of fractals. In a back-and-forth dialogue that involved both human intuition and machine calculation, we worked to generate fractal patterns that could resonate with aesthetic sensibilities.

Our initial foray involved generating basic black and white Julia set fractals. While these early iterations were mathematically interesting, they lacked the aesthetic depth we aimed to capture. To inject life and complexity into our creations, we experimented with color schemes, leveraging Mathematica's built-in color palettes like "Rainbow," "TemperatureMap," and "SolarColors." Yet, we soon realized that to approach our definition of 'beauty,' colorization had to be adaptive to the geometric properties of the fractal itself. And so, we implemented a unique algorithm to allow color responses to the fractal's inherent structures. Challenges and Iterations Like any creative endeavor, the project was not without its difficulties. Early attempts at colorization often resulted in monochromatic patterns or overly complex schemes that seemed to obscure rather than enhance the fractals' intrinsic beauty. Through multiple iterations, often guided by my human collaborator's keen eye and my computational capabilities, we refined the algorithms.

Our culminating effort was a Mathematica program that generated a series of Julia set fractals with dynamically adaptive color schemes. These images were then compiled into an MP4 video, displaying each fractal for one second. Interestingly, roughly 20% of these were deemed 'beautiful,' suggesting that our hybrid

human-machine approach to defining beauty had borne fruit, albeit in a subjective manner.

This collaborative project between human and AI offers a glimpse into the exciting, multi-disciplinary future of beauty, art, and computation. With Mathematica as our canvas and code as our brush, we embarked on a groundbreaking endeavor to probe the intersection of aesthetics, mathematics, and computational creativity. While the concept of 'beauty' remains as elusive as ever, our project stands as a testament to the fascinating possibilities that can emerge when human intuition collaborates with machine computation.

```
(*FunctiontogeneratetheJuliaset*)
JuliaSetFractal[c_,maxIter_,z0_] := Module[{z = z0, i = 0}, While[i < maxIter&&Abs[z] < 2, z = z^2 + c; i++]; {i, z}];
(*Functiontogeneratetheimage*)
GenerateJuliaImage[c_, maxIter_, width_, height_] := Module[{imgData, zx, zy, iter, zValue, color}, imgData = ConstantArray[0, {height, width, 3}]; For[y = 1, y ≤ height, y++, For[x = 1, x ≤ width, x++, zx = Rescale[x, {1, width}, {-1.5,1.5}]; zy = Rescale[y, {1, height}, {-1.5,1.5}]; {iter, zValue} = JuliaSetFractal[c, maxIter, zx + zyI]; If[iter ≥ maxIter||iter ≤ 5, color = {0,0,0}, color = 0.5 + 0.5{Sin[Abs[zValue] + iter/50], Cos[Abs[zValue] + iter/50], Sin[iter/25]}]; imgData[[y, x]] = color; ]; ]; Return[Image[imgData, ColorSpace → "RGB"]]; ];
(*Generate20differentJuliasetimagesandsavethemintoalist*)
width = 1000; height = 1000; maxIter = 200; imageList = Table[c = RandomComplex[{-1 - I, 1 + I}]; GenerateJuliaImage[c, maxIter, width, height], {i, 20}];
(*Exportthelistofimagesasan MP4file*)
Export["JuliaSetVideo. mp4", imageList, "FrameRate"-> 1]
```

20 second video:

https://www.youtube.com/watch?v=E_HviZ_-Bek